

CLAIMS

What is claimed is:

- 1 1. A method of discovering a network path that satisfies a quality of service (QoS)
2 requirement, the method comprising the computer-implemented steps of:
3 receiving, at a first router, a first data packet that indicates a destination and said QoS
4 requirement;
5 updating said first data packet to indicate an identity of said first router;
6 determining whether a least-delay path from said first router to said destination satisfies
7 said QoS requirement;
8 determining whether said first data packet has visited any router in said least-delay path
9 other than said first router;
10 if said least-delay path satisfies said QoS requirement and said first data packet has not
11 visited any router in said least-delay path other than said first router, then sending
12 said first data packet to a second router in said least-delay path; and
13 receiving, at said first router, a second data packet that indicates a path taken by said first
14 data packet to said destination.
- 1 2. The method of Claim 1, wherein said first router has links, and further comprising:
2 if said least-delay path does not satisfy said QoS requirement, then performing steps
3 comprising:
4 determining one or more of said first router's links that satisfy said QoS
5 requirement; and
6 sending a copy of said first data packet through said one or more of said first
7 router's links that satisfy said QoS requirement.
- 1 3. The method of Claim 1, wherein said first router has links, and further comprising:
2 if said first data packet has visited a router in said least-delay path other than said first
3 router, then performing steps comprising:
4 determining one or more of said first router's links that satisfy said QoS
5 requirement; and

6 sending a copy of said first data packet through said one or more of said first
7 router's links that satisfy said QoS requirement.

1 4. The method of Claim 1, further comprising:
2 in response to receiving said first data packet, updating a table to indicate that said first
3 router has received a copy of said first data packet.

1 5. A method of discovering a network path that satisfies a quality of service (QoS)
2 requirement, the method comprising the computer-implemented steps of:
3 receiving, at a first router, a data packet that indicates a destination and said QoS
4 requirement;
5 determining whether said data packet indicates that a path to said destination has been
6 found;
7 determining whether a least-delay path from said first router to said destination satisfies
8 said QoS requirement;
9 if said data packet indicates that a path to said destination has been found, and if said
10 least-delay path from said first router to said destination does not satisfy said QoS
11 requirement, then eliminating said data packet; and
12 if said data packet does not indicate that a path to said destination has been found, and if
13 said least-delay path from said first router to said destination satisfies said QoS
14 requirement, then performing steps comprising:
15 updating said data packet to indicate that a path to said destination has been
16 found; and
17 sending said data packet through said link that leads to said second router on said
18 least-delay path.

1 6. A method of discovering a network path that satisfies a quality of service (QoS)
2 requirement, the method comprising the computer-implemented steps of:
3 receiving, at a first router that has links, a data packet that indicates a destination and said
4 QoS requirement;
5 determining whether said first router previously has received a copy of said data packet;
6 if said first router previously has received a copy of said data packet, then eliminating
7 said data packet; and

8 if said first router previously has not received a copy of said data packet, then performing
9 steps comprising:
10 updating a table to indicate that said first router has received a copy of said data
11 packet;
12 determining whether said data packet indicates that a path to said destination has
13 been found;
14 determining whether a least-delay path from said first router to said destination
15 satisfies said QoS requirement;
16 if said data packet indicates that a path to said destination has been found, then
17 performing steps comprising:
18 if said least-delay path from said first router to said destination does not
19 satisfy said QoS requirement, then eliminating said data packet;
20 and
21 if said least-delay path from said first router to said destination satisfies
22 said QoS requirement, then sending said data packet through a link
23 that leads to a second router on said least-delay path; and
24 if said data packet does not indicate that a path to said destination has been found,
25 then performing steps comprising:
26 determining one or more of said first router's links that satisfy said QoS
27 requirement;
28 if said least-delay path from said first router to said destination does not
29 satisfy said QoS requirement, then sending a copy of said data
30 packet through said one or more of said first router's links that
31 satisfy said QoS requirement; and
32 if said least-delay path from said first router to said destination satisfies
33 said QoS requirement, then performing steps comprising:
34 determining whether said data packet has visited any router in said
35 least-delay path other than said first router;
36 if said data packet has visited a router in said least-delay path other
37 than said first router, then sending a copy of said data

38 packet through said one or more of said first router's links
39 that satisfy said QoS requirement; and
40 if said data packet has not visited any router in said least-delay
41 path other than said first router, then performing steps
42 comprising:
43 updating said data packet to indicate that a path to said
44 destination has been found; and
45 sending said data packet through said link that leads to said
46 second router on said least-delay path.

1 7. A method of discovering a least-cost network path, the method comprising the computer-
2 implemented steps of:
3 receiving, at a first router, a first data packet that indicates a destination;
4 updating said first data packet to indicate an identity of said first router;
5 determining whether said first data packet has visited any router in a least-cost path from
6 said first router to said destination, not including said first router;
7 if said first data packet has not visited any router in said least-cost path other than said
8 first router, then sending said first data packet to a second router in said least-cost
9 path;
10 if said first data packet has visited a router in said least-cost path other than said first
11 router, then sending said first data packet to a third router in a first least-delay
12 path from said first router to said destination; and
13 receiving, at said first router, a second data packet that indicates a path taken by said first
14 data packet to said destination;
15 wherein said least-cost path differs from said first least-delay path.

1 8. The method of Claim 7, further comprising:
2 receiving, at said second router, said first data packet;
3 determining whether a second least-delay path from said second router to said destination
4 satisfies a delay requirement indicated by said first data packet;
5 if said second least-delay path does not satisfy said delay requirement, then performing
6 steps comprising:

7 updating said first data packet to indicate a wrong way; and
8 sending said first data packet to said first router.

1 9. The method of Claim 8, further comprising:
2 receiving, at said first router, said first data packet;
3 determining whether said first data packet indicates a wrong way;
4 if said first data packet indicates a wrong way, then performing steps comprising:
5 updating said first data packet to not indicate a wrong way; and
6 sending said first data packet to said third router.

1 10. A computer-readable medium carrying one or more sequences of instructions for
2 discovering a network path that satisfies a quality of service (QoS) requirement, which
3 instructions, when executed by one or more processors, cause the one or more processors
4 to carry out the steps of:
5 receiving, at a first router, a first data packet that indicates a destination and said QoS
6 requirement;
7 updating said first data packet to indicate an identity of said first router;
8 determining whether a least-delay path from said first router to said destination satisfies
9 said QoS requirement;
10 determining whether said first data packet has visited any router in said least-delay path
11 other than said first router;
12 if said least-delay path satisfies said QoS requirement and said first data packet has not
13 visited any router in said least-delay path other than said first router, then sending
14 said first data packet to a second router in said least-delay path; and
15 receiving, at said first router, a second data packet that indicates a path taken by said first
16 data packet to said destination.

1 11. The computer-readable medium of Claim 10, wherein said first router has links, and
2 wherein said instructions, when executed by the one or more processors, cause the one or
3 more processors to carry out the steps of:
4 if said least-delay path does not satisfy said QoS requirement, then performing steps
5 comprising:

6 determining one or more of said first router's links that satisfy said QoS
7 requirement; and
8 sending a copy of said first data packet through said one or more of said first
9 router's links that satisfy said QoS requirement.

1 12. The computer-readable medium of Claim 10, wherein said first router has links, and
2 wherein said instructions, when executed by the one or more processors, cause the one or
3 more processors to carry out the steps of:
4 if said first data packet has visited a router in said least-delay path other than said first
5 router, then performing steps comprising:
6 determining one or more of said first router's links that satisfy said QoS
7 requirement; and
8 sending a copy of said first data packet through said one or more of said first
9 router's links that satisfy said QoS requirement.

1 13. The computer-readable medium of Claim 10, wherein said instructions, when executed
2 by the one or more processors, cause the one or more processors to carry out the steps of:
3 in response to receiving said first data packet, updating a table to indicate that said first
4 router has received a copy of said first data packet.

1 14. An apparatus for discovering a network path that satisfies a quality of service (QoS)
2 requirement, comprising:
3 means for receiving, at a first router, a first data packet that indicates a destination and
4 said QoS requirement;
5 means for updating said first data packet to indicate an identity of said first router;
6 means for determining whether a least-delay path from said first router to said destination
7 satisfies said QoS requirement;
8 means for determining whether said first data packet has visited any router in said least-
9 delay path other than said first router;
10 means for sending said first data packet to a second router in said least-delay path if said
11 least-delay path satisfies said QoS requirement and said first data packet has not
12 visited any router in said least-delay path other than said first router; and

means for receiving, at said first router, a second data packet that indicates a path taken by said first data packet to said destination.

15. The apparatus of Claim 14, wherein said first router has links, and further comprising:
means for determining one or more of said first router's links that satisfy said QoS requirement if said least-delay path does not satisfy said QoS requirement; and
means for sending a copy of said first data packet through said one or more of said first router's links that satisfy said QoS requirement if said least-delay path does not satisfy said QoS requirement.

16. The apparatus of Claim 14, wherein said first router has links, and further comprising:
means for determining one or more of said first router's links that satisfy said QoS requirement if said first data packet has visited a router in said least-delay path other than said first router; and
means for sending a copy of said first data packet through said one or more of said first router's links that satisfy said QoS requirement if said first data packet has visited a router in said least-delay path other than said first router.

17. The apparatus of Claim 14, further comprising:
means for updating, in response to receiving said first data packet, a table to indicate that said first router has received a copy of said first data packet.

18. An apparatus for discovering a network path that satisfies a quality of service (QoS) requirement, comprising:
a network interface that is coupled to a data network for receiving one or more packet flows therefrom;
a processor;
one or more stored sequences of instructions which, when executed by the processor, cause the processor to carry out the steps of:
receiving, at said apparatus, a first data packet that indicates a destination and said QoS requirement;
updating said first data packet to indicate an identity of said apparatus;
determining whether a least-delay path from said apparatus to said destination satisfies said QoS requirement;

13 determining whether said first data packet has visited any router in said least-
14 delay path other than said apparatus;
15 if said least-delay path satisfies said QoS requirement and said first data packet
16 has not visited any router in said least-delay path other than said
17 apparatus, then sending said first data packet to a router in said least-delay
18 path; and
19 receiving, at said apparatus, a second data packet that indicates a path taken by
20 said first data packet to said destination.

1 19. The apparatus of Claim 18, wherein said apparatus has links, and wherein said
2 instructions, when executed by the processor, cause the processor to carry out the steps
3 of:
4 if said least-delay path does not satisfy said QoS requirement, then performing steps
5 comprising:
6 determining one or more of said apparatus' links that satisfy said QoS
7 requirement; and
8 sending a copy of said first data packet through said one or more of said
9 apparatus' links that satisfy said QoS requirement.

1 20. The apparatus of Claim 18, wherein said apparatus has links, and wherein said
2 instructions, when executed by the processor, cause the processor to carry out the steps
3 of:
4 if said first data packet has visited a router in said least-delay path other than said
5 apparatus, then performing steps comprising:
6 determining one or more of said apparatus' links that satisfy said QoS
7 requirement; and
8 sending a copy of said first data packet through said one or more of said
9 apparatus' links that satisfy said QoS requirement.

1 21. The apparatus of Claim 18, wherein said instructions, when executed by the processor,
2 cause the processor to carry out the steps of:
3 in response to receiving said first data packet, updating a table to indicate that said
4 apparatus has received a copy of said first data packet.